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THE ROLE OF HEAVY CHEMICALS IN INDUSTRIAL DEVELOPMENT

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D. 12 (a)

THE ROLE OF HEAVY CHEMICALS IN INDUSTRIAL DEVELOPMENT

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1. In the past the development of industries in developing countries was frequently hampered by the absence of capital and enterpreneurship, and in addition this development was impossible as administrative and organizational skills were not available. At present, the developed countries are interested in providing funds to developing countries and are anxious to find suitable development projects. There is capital available for development which is not used due to the non-availability of schemes and plans for the utilization of this resource.

2. The writer maintains that the development of a heavy chemical industry is one of the best methods of utilizing capital, in order to help in the industrial development of a country. A case study based upon the development of a heavy chemical industrial complex in Haifa, Israel, is put forward as an example.

3. The agrarian economies of the tropical and semi-tropical countries are dependent upon intensive food production operations. As the agricultural methods are modernised and the use of fertilizers are introduced, the agricultural employment drops and labour is made available, which can be used by the Chemical Industry which in turn supplies the fertilizers to the Agriculturists. The fertilizer industry is thus not in competition with the agriculturist, either for labour or for capital, but is in many ways complementary.

4. (a) The Heavy Chemical Industry I am referring to is the industry which produces:

The Mineral Acids
Nitrogen fertilizers by Nitrogen fixation
Industrial gasses
Basic chemicals
and complete plant food fertilizers.

(b) Agriculture will adapt itself to available fertilizers if they are "on call", and in many cases the Chemical Industry can spark off the utilization of fertilizers due to its proximity to the agricultural community.

5. There have been arguments in the past between practical and theoretical economists as to the advisability of developing capital intensive industries in developing countries, but I submit that every developing country must start at least at the point reached by more developed countries and will only thus be able to develop its industrial potential - he Chemical Industry is an admirable way to develop industrial thinking and to telescope generations of development into a short period.

6. The case history which I am describing indicates that the essential in developing an industry is the following of a clear plan and the willingness both to import knowledge and to accept knowledge. Willing people learn quickly all over the world.

7. Short History

The heavy chemical plant in Haifa was considered and discussed in 1946, and immediately after the State of Israel was formed a committee of three were appointed by the Government, in order to put forward recommendations for the construction of a chemical plant. The report was submitted in 1948, accepted and construction started in the same year.

8. We were faced with the problem of little skilled labour and few skilled operators. We collected 12 people who had previous industrial experience. Our difficulties of implementation were increased as the country was going through a serious foreign currency shortage.

9. (a) The management of the new enterprise decided on

(A) a short term target of the construction of basic chemical plants

and

(B) the development of a chemical industry, which could subsequently utilize the ideas of our research institutes.

(b) The first essential was to utilize the nucleus of the industrially trained men available and to train the many skilled men, who would be needed for the operation and maintenance of the plants. It was obvious that only training within the plant would be possible for the vast majority of the men, only a select few could be sent abroad to learn modern production techniques.

10. It was decided rapidly to construct two small plants - a small Sulphuric Acid plant and a simple Superphosphate Den plant. The equipment for the plants was imported and speedily erected. The farmers in 1948 used 20,000 tons of fertilizers, all imported - sometimes the fertilizers were late in arriving, sometimes storage was difficult. Even the small Superphosphate plant gave a big impetus to agriculturists to increase the use of fertilizers. The knowledge that fertilizers were available as and when wanted led to studying methods of more economic application, and for instance the technique was developed that the first application of fertilizer was made with the first cultivation in May, thus saving the labour required. The whole attitude of the farmers changed with the knowledge that a local material was available.

11. (a) The small initial plant was used as a pilot operation for the training of personnel and for the establishment of industrial thinking. It was rapidly followed by the construction of a large integrated plant, which is nowproducing all Israel's requirements of basic chemicals.

(b) The small initial plant,which had a total investment of about $300,000 and employed 35 men, had to bring in Phosphate Rock from either Morrocco

or Florida. 7 to 10,000 ton shipments were difficult to finance and also costly to store. It was natural that the management of the plant should press on the Geological Survey people to accelerate surveys of suitable areas where Phosphate Rock might be found. There was Rock in the area, and the first vertical development was the entry into the mining field. There is no doubt that but for the need of Rock for the plant many years would have gone by before Phosphate Rock would have been exploited. As it is, a large operation was born, which now exports half its rock and there are plans for a tenfold expansion. The mining operation entailed training miners, surveyors, and in its wake there followed a course for ore dressing in the Institute of Technology and a more scientific approach to all the quarrying methods in the country.

12. The next development resulting from this was the establishment of a heavy transport organization. Phosphate Rock is cheap only if cheaply transported. In 1950 the first steps were taken by the Chemical plant to purchase 12 heavy 30 ton trucks for the transport of Rock - the first really heavy trucks in the country. It was decided that it is better to run a transport organization separately. A transport company was formed and has grown to an organization which now owns 140 heavy vehicles, all between 30 and 40 ton capacity and which move all the Rock, Salt and Potash in the country. In turn, this entailed service facilities - training of personnel, erection of transfer points and all the trimmings of a modern haulage concern.

13. Training of Personnel

(a) The Management forecast that the completed integrated Chemical plant would employ about 900 to 1000 people, and it was decided that recruitment would commence as soon as possible to enable as many people as possible to learn the plant during the construction period by working on the building and erection and to become acquainted with the necessary administrative and technical operations of the plant. In 1951 a series of training schools were set up in the plant - first of all a school for the learning of Hebrew which is the official language of the country - but in 1951 we had 30 languages spoken among the 250 men employed, and since successful communication is the first essential in any organization, a common language was of vital importance.

(b) The background of the trainees was very broad - agricultural workers, small shopkeepers, Bible students, tailors, bakers - in fact every human occupation appeared to be represented. Since we intended to build a highly technical plant, the first essential was an understanding of technical instructions, drawings, and such basic principles as temperature measurement, pressure control and the first elements of Chemistry. Courses were given half in the employees time and half in the Company's time.

14. Then came the specialist schools:

(a) Lead Burning

A large chemical plant uses a lot of lead - the manipulation of lead was practically unknown in the country - a contract was placed for several thousand tons of lead work with a British firm with a definite stipulation that lead burning must be taught to 12 of our men. The condition was carried out and there are now ample facilities for lead work in the country, both inside the firm and outside (inevitably some trainees leave the company in

due course). The facilities available are used by other industries and have greatly simplified chemical construction in the country.

(b) Welding

Everywhere one goes these days one sees welding being done - 2 pieces of metal stuck together with some weld metal, but this is useless for a modern plant and or for the construction of stressed structures. There was plenty of this type of semi-professional welding in the country - we decided we needed high grade welding, metallurgical control and proper inspection. This entailed placing a contract with a company specializing in welding training in England and the organization of coupon testing. A school was set up in the plant and all welders passed through the school. The welders after schooling were classified into 3 grades and the highest grade have regular refresher courses. The result is that high grade welding is now commoner in the country, and with the completion of major construction work in our Company high class welders are available to other enterprises and form the nucleus of the skilled personnel in fabrication shops, ship repair yards and steel construction facilities.

(c) Rubber Lining and Plastic Working

(i) A similar technique was adopted - licences with training were purchased from England and France, so that facilities would be available. High quality work is being done and has resulted in the development of an industry which is manufacturing chemical equipment and even exporting it to European users.

(ii) In this way crafts, which were non-existent and which are essential to a growing chemical industry, were provided and have by a snow ball effect grown and developped into interesting ancillary enterprises.

(iii) In this connection, it must be said that substantial Government aid in such training programmes is justified as the fund of knowledge built up is a national asset rather than a company asset. It is impossible to find real means other than those of persuasion and provision of interesting work to hold on to the trainees in the training company. This is also a form of foreign aid which is most appreciated, subject to it being provided by really practical men who know the job themselves from the artisans point of view. The skills learned are not difficult to absorb by people with a secondary school education. The idea that it takes generations to form an industrially skilled populace is in many ways a superstition and is also a convenient safeguard against the flooding of the labour market by new recruits. Our experience is that psycho-technical tests weed out the hopeless cases rapidly - the hopeful ones learn quickly and given proper encouragement become adept at their work.

(d) Engineering and Administrative Training

(i) The most important training from the long-term point of view was the engineering and administrative training which was partially planned but to a large extent was due to the foreign currency shortage. The USA engineering contractors for the main plants were asked to reduce to a minimum the

foreign currency expenditure, and it was agreed that an engineering office would be set up locally to produce all the necessary engineering drawings. In addition our personnel were trained in modern erection methods and up-to-date construction planning, purchasing and progressing.

(ii) Over 50 graduates were trained in this way, and now are the mainstay of the company's and of other chemical company's technical and managerial staff. Simultaneously a progressive personnel management programme was instituted which has been studied by ILO [a]

15 The construction period.

(a) The major plant to be built meant an expenditure of about 25 million $. Of this sum approximately 30% was purchased from abroad in the form of finished equipment and the balance was spent in the country over a period of 5 years with a peak spending of $7\frac{1}{2}$ million per year mostly locally in the Haifa Area. Of this one third was civil engineering work and the rest fabrication, erection, piping, etc. The fabrication facilities in the Haifa area in effect grew up as the result of this expenditure, and facilities were formed which have subsequently been extended to become local industries of substantial importance. At least three major fabrication shops were formed which are now manufacturing grain silos, boilers, domestic water heaters, etc. both for the home market and for export. The training during the construction period of the plant has left a permanent mark on the industrial set up of the area. Quality control, Xray inspection techniques and proper programming and progressing were installed in the local shops.

(b) The construction of such a large plant gave a serious fillip to a number of ancillary industries, such as the manufacture of pumps, switchgear and in one case justified the installation of a modern gear cutting machine in a mechanical shop which now manufactures a series of standard reduction gears.

16. Repercussions on other Industry

(a) Apart from the sparking off of the ancillary or service industries connected with the construction period of the plant, the Chemical Industry has a direct and impressive effect on the development of other industries.

(b) We have dealt with the development of a mining industry and its related transport organization.

(c) The Haifa Chemical Industry first and foremost created a demand for fertilizers - 28,000 tons in 1948 250,000 tons used in 1960 - The growth is of course due to Agricultural development, new crops with more irrigation and better techniques, but all these would have been held back if it had not been for the local availability of fertilizers of all types.

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[a] Personnel relations in a growing enterprise: A case study of an Israeli undertaking.
ILO Labour-Management Relations Series: No. 12
International Labour Office, Geneva (1962)

(d) Production of Detergents was greatly helped by the availability of local oleum and phosphate detergent builders. Simultaneously the production of detergents has released expensive edible fats from soap production.

(e) Cattle feed additives are produced which replace imported bone meal.

(f) The Paper Industry both serves the Chemical Industry by the provision of paper bags and uses the chemicals produced in its production processes.

(g) Carbonic and Dry Ice (by-products of the Ammonia plant) ease the lot of the food industries and help their transportation and export possibilities.

(h) Welding gasses including Argon have made possible local stainless steel fabrication and lamp manufacture at reasonable prices.

(i) Due to the availability of the basic materials, modern techniques skills and trained personnel, there is no hesitation now in constructing a Poly-Ethylene plant, a carbonblack plant, a PVC plant, an Alkoloid extraction plant and many more sophisticated plants which were not dreamt of previously.

(j) In addition the Chemical Industry is now beginning to proceed to its next objective, i. e. the conversion of Research ideas into chemicals for sale. Over 75% of the products of the Chemical Industry are sold to other industries and only 25% go directly to consumers - the live and expanding chemical industry is always looking for new outlets and encouraging new industries, such as paint manufacturing units, chemicals for buildings and chemicals for the food processing industries.

(k) Since 1948 the Chemical Industry in Israel has grown from an employment of 600 to an employment of 7000 (1200 in the Heavy Chemical plant described) with a turnover of $90,000,000.

17(a) The total effect of . Chemical construction project is much greater than the arithmetical sum of the components of the project. Each and every skill learned, every project completed opens up new horizons and increases the possibilities of the economy's development.

(b) I fully agree with the economists, such as Gerschenhem who says that to achieve success in a developing country, the most modern and efficient techniques must be used.

(c) It is easier to apply these techniques to a capital intensive plant, such as a heavy chemical plant. Such a project needs initiative which is frequently available as a result of newly found freedom, the project needs capital which is liable to be available from one of the international funding organization, and it needs managerial skill and technological skills - the last two factors are the most mobile commodities and can in these times be purchased without any difficulty. Granted the above conditions, the project will fulfil its targets and in its wake have considerable repercussions on the total development of the country.

Figure I

Foremen Training

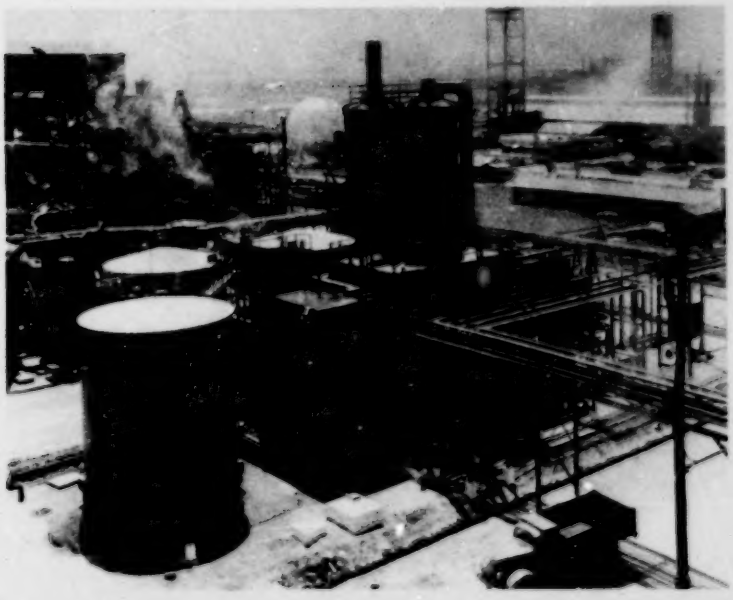

Figure II

General view of Plant

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